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RESPONSE TRANSMITTAL AND FEE AUTHORIZATION

	ATTORNEY DOCKET NO. 10919/25501		APPLICATION NO. 09/976,559	
FILING DATE OCTOBER 12, 2001	CONFIRMATION NO. 1434	CUSTOMER NO. 29937	EXAMINER SHUN K. LEE	GROUP ART UNIT 2878
APPLICANT(S): PRADIP MITRA				
TITLE OF INVENTION: PLANAR GEOMETRY BURIED JUNCTION INFRARED DETECTOR AND FOCAL PLANE ARRAY				

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Douglas A. Sorensen
Name of Applicant, Assignee, or Registered Representative

Signature

January 25, 2005
Date of Signature

TRANSMITTED HEREWITH FOR THE ABOVE IDENTIFIED PATENT APPLICATION IS:

- ☒ (A) A response to the Office Action dated: July 21, 2004
- ☐ (B) A Petition for Extension of Time
  ☐ for 1 month ☐ for 2 months ☐ for 3 months;
  A Petition for Extension of Time, having been previously filed,
  ☐ for 1 month ☐ for 2 months ☐ for 3 months
- ☐ (C) A Notice of Appeal. $
- ☒ (D) An Appellant's Brief on Appeal. $500.00
- ☐ (E) Other: $
- ☐ (F) A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27
- ☐ Small entity status under 37 CFR § 1.27 has been previously established
- ☐ The claims fee, if any, has been calculated as shown below

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NO. PREVIOUSLY PAID FOR	PRESENT EXTRA
TOTAL		MINUS		
INDEP.		MINUS		
FIRST PRESENTATION OF MULTIPLE DEP. CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADD'L FEE		LARGE ENTITY RATE	LARGE ENTITY ADD'L FEE
x $100	$	OR	x $50	$
x $25			x $200	
+ $180			+ $360	
TOTAL ADD'L FEE	$ 0.00		TOTAL ADD'L FEE	$ 0.00

- ☒ Please charge $500.00 to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260, which includes
  ☐ the amount of $ for the claims fee calculated above AND/OR
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January 25, 2005

SIDLEY AUSTIN BROWN & WOOD LLP
717 N. Harwood, Suite 3400
Dallas, Texas 75201
Main: (214) 981-3300
Direct: (214) 981-3482
Facsimile: (214) 981-3400

By:
Douglas A. Sorensen
Attorney for Applicants
Registration No. 31,570

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application No.:	09/976,559
Applicant(s):	Pradip MITRA
For:	PLANAR GEOMETRY BURIED JUNCTION INFRARED DETECTOR AND FOCAL PLANE ARRAY
Confirmation No.:	1434
Customer No.:	29937
Docket No.:	10919/25501
Filed:	October 12, 2001
Group Art Unit:	2878
Examiner:	Shun K. Lee

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January 25, 2005
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Douglas A. Sorensen
Name of Applicant, Assignee, or Registered Representative

Signature

January 25, 2005
Date of Signature

MS APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313–1450

Dear Sir:

BRIEF FOR APPELLANT

This is an appeal from the Final Rejection dated July 21, 2004, rejecting claims 1-54 in the present Application. A Notice of Appeal was filed on December 20, 2004, resulting in an Appeal Brief due date of February 20, 2004.

01/31/2005 HDEMESS1 00000024 181260 09976559
01 FC:1402 500.00 DA

This brief is accompanied by a Response Transmittal and Fee Authorization, authorizing the requisite fee of $500.00 as set forth in § 1.17(c). In the event that the Response Transmittal and Fee Authorization is not enclosed, please charge any required fee (other than an issue fee) during the pendency of this Application to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260. Please credit any excess payment to the same account.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time under 37 CFR § 1.136(a) for a period of time sufficient to enable this document to be timely filed. Any fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 CFR §§ 1.16 and 1.17, other than an issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood LLP's Deposit Account 18-1260. Any refund should be credited to Deposit Account 18-1260.

REAL PARTY IN INTEREST (37 C.F.R. § 41.37(c)(1)(i))

The real party in interest in the present Application is Lockheed Martin Corporation, a corporation of the State of Maryland, having an office at 6801 Rockledge Drive, Bethesda, Maryland, USA.

RELATED APPEALS AND INTERFERENCES (37 C.F.R. § 41.37(c)(1)(ii))

There are no related appeals or declared interferences which will directly affect or be directly affected by the present Application to the knowledge of the undersigned.

STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

This Application was filed as U.S. Application Serial No. 09/976,559 on October 12, 2001, and claims priority from no other application.

The Application was filed with fifty-four (54) claims, all of which are now pending and the subject of this appeal.

The status of the claims is, therefore, believed to be as follows:

Allowed claims:	None
Claims objected to:	None
Claims rejected:	1-54
Withdrawn claims:	None

Appellants hereby appeal the Examiner's final rejection of claims 1-54 in this matter which presently stand rejected over the cited references of record.

Appealed Claims 1-54, as amended, are set forth in Appendix A (attached hereto) pursuant to 37 C.F.R. § 41.37(c)(1)(viii).

STATUS OF AMENDMENTS (37 C.F.R. § 41.37(c)(1)(iv))

Amendments under 37 C.F.R. §1.116 were filed by Appellants on November 12, 2004 in response to the Final Office Action dated July 21, 2004. These amendments were not entered as noted in the Advisory Action dated December 13, 2004. The claims as listed in Appendix A do not include the amendments offered in the After Final amendment filed November 12, 2004.

SUMMARY OF INVENTIONS (37 C.F.R. § 41.37(c)(1)(v))

The invention of claim 1 involves a process for the fabrication of a photodetector. An absorber layer 16, preferably of mercury cadmium zinc telluride (HgCdZnTe), is formed on a substrate using epitaxial deposition techniques. Preferably, a wider band gap

layer 18 is formed on absorber layer 16. This is followed by a passivation layer 20. A doping source layer 21 is then formed on the surface of passivation layer 20 as show in Figure 3 (¶ 0017). The doping source layer is patterned to form doped mesa 23 as shown in Figure 5 (¶ 0023). Dopant is then driven by annealing from the doped mesa through the passivation layer, through the wider band gap layer, into the absorber layer. Of importance, at no time during the process for forming doped region 22 were sensitive absorber layer 16 or wider band gap layer 18 exposed, particularly to the process of removing doped mesa 23. An opening is then formed in the passivation layer 20 to allow formation of an electrical contact (25, 25 and 26) to doped region 22.

The invention of claim 6 includes the further limitation to the invention of claim 1 that the absorption layer, wider bandgap layer and the passivation layer are formed by depositing alternating layers of HgTe and CdZnTe having precise thicknesses such that the resulting layer has a selected precise band gap for absorbing the desired radiation (¶ 0018).

The invention of claim 14 is a structure including a radiation absorption 16 layer formed above the substrate. A wider bandgap layer 18 is above the radiation absorption layer. A passivation layer 20 is above the wider bandgap layer. A doped region extends through the passivation layer into the wider bandgap layer and the radiation absorption layer. An electrical contact provides electrical contact to the doped region.

The invention of claim 20 is a radiation detector formed using the process of claim 6.

The invention of claim 28 is a process for forming a radiation detector where a radiation absorption layer 16 is formed above a substrate. A passivation layer 20 is formed above the radiation absorption layer (¶ 0018). A patterned doped mesa 23 is formed above the passivation layer (¶ 0023). Dopant is driven from the patterned doping layer into the radiation absorption layer to form a doped region 22. An electrical contact (24, 25, 26) is then formed to the doped region (¶ 0024).

The invention of claim 33 includes the further limitation to the invention of claim 28 that the absorption layer, wider bandgap layer and the passivation layer are formed by depositing alternating layers of HgTe and CdZnTe having precise thicknesses such that the resulting layer has a selected precise band gap for absorbing the desired radiation (¶ 0018).

The invention of claim 41 is a structure including a radiation absorption 16 layer formed above the substrate. A passivation layer 20 is above the wider bandgap layer. A doped region 22 extends through the passivation layer into the wider bandgap layer and the radiation absorption layer. An electrical contact (24, 25, 26) provides electrical contact to the doped region.

The invention of claim 47 is a radiation detector formed using the process of claim 33.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. § 41.37(c)(1)(vi))

Issue No. 1: Claims 28, 29, 31, 32, 41, 42, and 44-46 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,956,304 to Cockrum *et al.* ("Cockrum").

Issue No. 2: Claims 1, 2, 4, 5, 14, 15, and 17-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of U.S. Patent No. 4,961,098 to Rosbeck *et al.* ("Rosbeck").

Issue No. 3: Claims 30, 33, 35-40, 43, 47, and 49-54 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of U.S. Patent No. 5,998,235 to Mitra ("Mitra").

Issue No. 4: Claims 3 and 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of Rosbeck as applied to claims 1 and 14 above, and further in view of Mitra.

Issue No. 5: Claims 6, 8-13, 20, and 22-27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of Rosbeck and Mitra.

Issue No. 6: Claims 33, 34, 37, 39, 40, 47, 48, 51, 53, and 54 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of U.S. Patent No. 4,566,918 to Irvine *et al.* ("Irvine").

Issue No. 7: Claims 6, 7, 10, 12, 13, 20, 21, 24, 26, and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of Rosbeck and Irvine.

ARGUMENT (37 C.F.R. § 41.37(c)(1)(vii)

A. Cited References

The Examiner relied upon four references in the Final Office Action: The Cockrum, Rosbeck, Mitra and Irvine patents. In order to avoid undue repetition of background information and needless restatements as to the subject matter of these references, a discussion of each of the references is be provided here.

For each respective discussion of the above references in view of the aforesaid issues, a shorter treatment of the appropriate references shall be provided. Where appropriate, the reader will be referred back to this section to review a reference, if necessary.

1. The Cockrum Patent

The Cockrum patent shows a process for forming buried junction photodetectors in tertiary semiconductor compounds such as mercury cadmium telluride (HgCdTe). The

process shown in Figures 4A-4K has been the focus of the rejections and thus is described here. A passivation layer 18 is formed on a p-type layer 12. A mask layer 26 is then formed and patterned on the surface of the passivation layer 18. The mask layer 26 is used to pattern passivation layer 18 to selectively expose p-type layer 12. A doping source layer 30 is then formed on the surface of the patterned structure with the mask layer 26 in place. The mask layer 26 is then removed. This step patterns doping source layer 30 and removes the portion of layer 30 above passivation layer 18. This structure is then heated to diffuse the N-type source from the doping source layer 30 where it contacts the p-type layer. This forms n-type regions 14a and 14b.

2. <u>The Rosbeck Patent</u>

The Rosbeck patent shows the use of a wider band gap layer 16 with a base layer 14 to improve the leakage and impedance characteristics of a HgCdTe photodetector. (Column 3, Line 54 – Column 4, Line 4).

3. <u>The Mitra Patent</u>

The Mitra patent shows a process for forming a HgCdZnTe layer with a carefully controlled ratio of mercury to the cadmium-zinc compound, thus controlling the band gap of the material. Alternating layers of mercury telluride (HgTe, 24, 26, 28, 30 ...) and cadmium zinc telluride ($Cd_{0.944}Zn_{0.056}Te$, 32, 34, 36, 38 ...) are formed using epitaxial deposition. In addition, the cadmium zinc telluride compound has a cadmium mole fraction ration of 0.944 and a zinc mole fraction ratio of 0.056. These mole fraction ratios produce a crystal structure with better lattice matching to the HgTe layer, thus reducing the dislocation defect density of the resulting layer. The thicknesses of the layers (t_1 and t_2, respectively) are selected in accordance with the final desired ratio of cadmium and mercury in the final compound. After annealing, the alternating layers become a heterogeneous quaternary mercury cadmium zinc telluride alloy. (Column 4, lines 11-16).

4. The Irvine Patent

The Irvine patent shows a process similar to the Mitra patent for forming a HgCdTe layer with a carefully controlled ratio of mercury to cadmium, thus controlling the band gap of the material. Alternating layers of mercury telluride (HgTe, 35, 35_1, 35_2, 35_3 ...) and cadmium telluride (CdTe, 36, 36_1, 36_2, 36_3 ...) are formed using epitaxial deposition. The thicknesses of the layers (t_1 and t_2, respectively) are selected in accordance with the final desired ratio of cadmium and mercury in the final compound. The layers of the multilayer structure are very thin, so that these layers completely interdiffuse during the deposition process.

B. Issue No. 1

1. Claims 28, 29, 31 and 32

The rejection of claims 28, 29, 31, 32, 41, 42, and 44-46 under 35 U.S.C. § 102(b) as being anticipated by Cockrum, is respectfully traversed based on the following.

In contrast to the cited reference, Claim 28 includes the steps of:

> forming a patterned doping layer above the passivation layer;
> driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region; ...

The Office Action states that "Cockrum *et al.* teach (column 6, lines 15-62) forming a patterned doping layer (30 in Figs. 4E and 4F) above the passivation layer (26 in Figs 4C-44E) [sic]and driving (*i.e.* thermally diffusing) dopant from the patterned doping layer (30 in Figs. 4E and 4F) into the radiation absorption layer (12 in Fig. 4F) to form a doped region (14a or 14b in Figs. 4G-4K)."

Applicant respectfully disagrees with this analysis of the Cockrum reference. In Figure 4E of Cockrum, the doping source layer 30 is not patterned. In Figure 4F, the doped source layer 30 has been patterned by a "lift off" process due to the removal of

mask layer 26. However, this lift off process removes all of those portions of source layer 30 that are above the passivation layer 18. Before this lift off patterning, source layer 30 is not patterned. After this step, no part of source layer 30 remains above passivation layer 18.

The claim requires "forming a patterned doping layer above the passivation layer." Thus, two limitations must be met in this element: 1) the doping layer must be above the passivation layer; AND 2) it must be patterned. Cockrum shows an unpatterned source layer 30 that is partially above passivation layer 18. In the subsequent step, Cockrum also shows a source layer 30 that is patterned, but this patterned source layer does not include any portion above passivation layer 18. Therefore, Cockrum does not show or suggest "forming a patterned doping layer above the passivation layer." To anticipate a claim, the reference must show, expressly or inherently, every limitation of the claim. MPEP §2131. Therefore, the cited reference does not anticipate claim 28. Claims 29, 31 and 32 are dependent upon claim 28 and thus include every limitation of claim 28. Therefore, claims 29, 31 and 32 are also not anticipated by the cited reference.

2. <u>Claims 41, 42, and 44-46</u>

Also in contrast to the cited reference, Claim 41 includes:

> a doped region extending through the passivation layer into the radiation absorption layer; ...

As noted above, neither Cockrum nor Rosbeck show or suggest "forming a <u>patterned</u> doping layer <u>above</u> the passivation layer." Because the source layer 30 of Cockrum is not above the passivation layer 18 and is in direct contact with the p-type layer 12, no "a doped region extending through the passivation layer into the radiation absorption layer" is formed. Therefore, Cockrum does not show or suggest the quoted limitation. Thus, the cited reference does not show or suggest every limitation of claim 41. Therefore, claim 41 is not anticipated by the cited reference. Claims 42 and 44-46 are

dependent upon claim 41 and thus include every limitation of claim 41. Therefore, claims 42 and 44-46 are also not anticipated by the cited reference.

C. **Issue No. 2**

Claims 1, 2, 4, 5, 14, 15, and 17-19 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Rosbeck. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

1. **Claims 1, 2, 4 and 5**

In contrast to the cited references, claim 1 includes:

> forming a patterned doping layer above the passivation layer;
> driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region; ...

As noted above with regard to claim 28, Cockrum does not show or suggest "forming a patterned doping layer above the passivation layer." Rosbeck merely shows the use of a wider band gap layer with a base layer. It does not show or suggest "forming a patterned doping layer" at all. To support a *prima facie* case for obviousness, the combined references must show or suggest every limitation of the claim. MPEP §2143.03. Because neither of the cited references shows or suggests "forming a patterned doping layer above the passivation layer," the cited references do not support a *prima facie* case for obviousness. Claims 2, 4 and 5 are dependent upon claim 1 and thus include every limitation of claim 1. Therefore, the cited references do not show of suggest every limitation of claims 2, 4 or 5, and thus these claims are also non-obvious.

2. **Claims 14, 15, and 17-19**

Also in contrast to the cited references, claim 14 includes:

> a doped region extending through the passivation layer into the wider bandgap layer and the radiation absorption layer; ...

As noted above, neither Cockrum nor Rosbeck show or suggest "forming a patterned doping layer above the passivation layer." Because the source layer 30 of Cockrum is not above the passivation layer 18 and is in direct contact with the p-type layer 12, no " doped region extending through the passivation layer into the wider bandgap layer and the radiation absorption layer" is formed. Therefore, Cockrum does not show or suggest the quoted limitation. Rosbeck merely shows the use of a wider band gap layer with a base layer. Thus, neither reference shows or suggest the quoted limitation. Because the cited references do not show or suggest every limitation of claim 14, the cited references do not support a *prima facie* case for obviousness of claim 14. Claims 15 and 17-19 are dependent upon claim 14 and thus include every limitation of claim 14. Therefore, the cited references do not show or suggest every limitation of claims 15 and 17-19 and thus these claims are also non-obvious.

D. Issue No. 3

Claims 30, 33, 35-40, 43, 47, and 49-54 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Mitra. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

1. Claim 30

Claim 30 is dependent upon claim 28 and thus includes every limitation of claim 28. As noted above, the Cockrum reference does not show or suggest "forming a patterned doping layer above the passivation layer." Mitra merely shows a process for making a layer having a precise band gap. Thus, Mitra also does not show or suggest "forming a patterned doping layer above the passivation layer" and does not suggest this step when combined with the Cockrum reference. Therefore, the cited references do not show or suggest every limitation of claim 30 and do not support a *prima facie* case for obviousness of claim 30.

2. Claims 33 and 35-40

In contrast to the cited references, claim 33 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region; ...

As noted above with regard to claim 30, the cited references do not show or suggest "forming a patterned doping layer above the passivation layer." Thus, the combined references do not show or suggest every limitation of claim 33. Therefore, the cited references do not support a *prima facie* case for obviousness of claim 33. Claims 35-40 are dependent upon claim 33 and thus include every limitation of claim 33. Therefore, the cited references also do not support a *prima facie* case for obviousness of claims 35-40.

3. Claim 43

As noted above with regard to claim 41, Cockrum does not show or suggest a doped region that extends through the passivation layer into the radiation absorption layer. Mitra similarly does not show or suggest this feature and does not suggest this feature when combined with the Cockrum reference. Therefore the cited references do not show or suggest every limitation of claim 43 and do not support a *prima facie* case for obviousness of claim 43.

4. Claims 47 and 49-54

In contrast to the cited references, claim 47 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;

> driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region; ...

As noted above with regard to claim 43, the cited references do not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of these references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 47. The cited references do not show or suggest these limitations and thus do not support a *prima facie* case for obviousness of claim 47. Claims 49-54 are dependent upon claim 47 and thus include every limitation of claim 47. Therefore, claims 49-54 the cited references also do not support a *prima facie* case for obviousness of claims 49-54.

E. <u>Issue No. 4</u>

Claims 3 and 16 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Rosbeck as applied to claims 1 and 14 above, and further in view of Mitra. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

As noted above with regard to claim 1, the Cockrum reference does not show or suggest "forming a patterned doping layer above the passivation layer." Rosbeck merely shows the use of a wider band gap layer with a base layer. Mitra merely shows a process for making material having precise band gap properties. Neither of these references similarly does not show or suggest "forming a patterned doping layer above the passivation layer." Claim 3 is dependent upon claim 1 and thus includes every limitation of claim 1. Therefore the cited references, singularly or in combination, do not show or suggest every limitation of claim 3 and claim 3 is non-obvious.

As noted above with regard to claim 14, Cockrum does not show or suggest a doped region that extends through the passivation layer into the radiation absorption layer.

Rosbeck also does not show or suggest this feature. Mitra similarly does not show or suggest this feature and does not suggest this feature when combined with the Cockrum and Rosbeck references. Claim 16 is dependent upon claim 14 and thus includes every limitation of claim 14. Therefore the cited references do not show or suggest every limitation of claim 16 and claim 16 is non-obvious.

F. Issue No. 5

Claims 6, 8-13, 20, and 22-27 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Rosbeck and Mitra. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

1. Claims 6 and 8-13

In contrast to the cited references, claim 6 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region; ...

The Cockrum, Rosbeck and Mitra references, singularly or in combination, do not show or suggest forming a patterned doping layer above a passivation layer. As noted above, the only patterned doping layer in any of these references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 6. Therefore, the cited references do not show or suggest every element of claim 6 and do not support a *prima facie* case for obviousness of claim 6. Claims 8-13 are dependent upon claim 6 and thus include every limitation of claim 6. Therefore, the cited references also do not support a *prima facie* case for obviousness of claims 8-13.

2. Claims 20 and 22-27

Also in contrast to the cited references, claim 20 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region;...

The Cockrum, Rosbeck and Mitra references, singularly or in combination, do not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of these references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 20. Therefore, the cited references do not show or suggest every element of claim 20 and do not support a *prima facie* case for obviousness of claim 20. Claims 22-27 are dependent upon claim 20 and thus include every limitation of claim 20. Therefore, the cited references also do not support a *prima facie* case for obviousness of claims 22-27.

Accordingly, it is respectfully requested that the rejection of claims 6, 8-13, 20, and 22-27 under 35 U.S.C. § 103(a) as being unpatentable over Cockrum in view of Rosbeck and Mitra, be reconsidered and withdrawn.

G. Issue No. 6

Claims 33, 34, 37, 39, 40, 47, 48, 51, 53, and 54 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Irvine. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

1. Claims 33, 34, 37, 39 and 40

In contrast to the cited references, claim 33 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region; ...

As noted above, the Cockrum reference does not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of the cited references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Irvine merely shows a method of making a layer having a selected band gap. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 33. Therefore, the cited references do not support a *prima facie* case for obviousness of claim 33. Claims 34, 37, 39 and 40 are dependent upon claim 33 and thus include every limitation of claim 33. Therefore the cited references do not show or suggest every limitation of claims 34, 37, 39 and 40 and the cited references do not support a *prima facie* case for obviousness of these claims.

2. <u>Claims 47, 48, 51, 53 and 54</u>

In contrast to the cited references, claim 47 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region;

As noted above, the Cockrum reference does not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of the cited references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Irvine merely shows a method of making a layer having a selected band gap. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is

"above the passivation layer" as provided in claim 47. Therefore, the cited references do not show or suggest every limitation of claim 47 and do not support a *prima facie* case for obviousness of claim 47. Claims 48, 51, 53 and 54 are dependent upon claim 47 and thus include every limitation of claim 47. Therefore, the cited references do not show or suggest every limitation of claims 48, 51, 53 and 54 and do not support a *prima facie* case of obviousness of claims 48, 51, 53 and 54.

H. <u>Issue No. 7</u>

Claims 6, 7, 10, 12, 13, 20, 21, 24, 26, and 27 stand rejected under 35 U.S.C. § 103(a), as being unpatentable over Cockrum in view of Rosbeck and Irvine. However, as shown below, these references do not support a *prima facie* case for obviousness of these claims.

1. <u>Claims 6, 7, 10, 12 and 13</u>

In contrast to the cited references, claim 6 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region; ...

The Cockrum, Rosbeck and Irvine references, singularly or in combination, do not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of the cited references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 6. Therefore, the cited references do not show or suggest every element of claim 6 and thus do not support a *prima facie* case for obviousness of claim 6. Claims 7, 10, 12 and 13 are dependent upon claim 6 and thus include every limitation of claim 6. Therefore, the cited

references also do not support a *prima facie* case for obviousness of claims 7, 10, 12 and 13.

2. Claims 20, 21, 24, 26, and 27

Also in contrast to the cited references, claim 20 includes:

> forming a doping layer above the passivation layer;
> ...
> patterning the doping layer;
> driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region;...

The Cockrum, Rosbeck and Irvine references, singularly or in combination, do not show or suggest forming a patterned doping layer above the passivation layer. As noted above, the only patterned doping layer in any of the cited references is layer 30 of Figure 4F of Cockrum, but no portion of this layer is above passivation layer 18. Thus, the cited references, singularly or in combination, do not suggest "driving dopant from the patterned doping layer" that is "above the passivation layer" as provided in claim 20. Therefore, the cited references do not show or suggest every element of claim 20 and thus do not support a *prima facie* case for obviousness of claim 20. Claims 21, 24, 26 and 27 are dependent upon claim 20 and thus include every limitation of claim 20. Therefore, the cited references also do not support a *prima facie* case for obviousness of claims 21, 24, 26 and 27.

I. Conclusion

In view of the foregoing, no case for anticipation or *prima facie* case of obviousness has been established with regard to any of Claims 1-54. Accordingly, the Appellant respectfully requests the Board of Patent Appeals and Interferences to reverse the Examiner's rejections as to all of the appealed claims.

Respectfully submitted,

By: ______________________
Douglas A. Sorensen
Reg. No. 31,570
Attorney for Appellant

DAS/jkk
SIDLEY AUSTIN BROWN & WOOD LLP
717 N. Harwood, Suite 3400
Dallas, Texas 75201
(214) 981-3482 (Direct)
(214) 981-3300 (Main)
(214) 981-3400 (Facsimile)
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APPENDIX A

(37 C.F.R. § 41.37(C)(1)(viii))

1. A method for forming a radiation detector, comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a wider bandgap layer above the radiation absorption layer;

forming a passivation layer above the wider bandgap layer;

forming a patterned doping layer above the passivation layer;

driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region; and

forming an electrical contact to the doped region.

2. A method as in Claim 1 wherein the absorption layer includes HgCdTe.

3. A method as in Claim 1 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x Te$.

4. A method as in Claim 1 wherein the dopant is p-type.

5. A method as in Claim 1 wherein the dopant is arsenic.

6. A method for forming a radiation detector, comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a wider bandgap layer above the radiation absorption layer;

forming a passivation layer above the wider bandgap layer;

forming a doping layer above the passivation layer;

wherein the absorption layer, the wider bandgap layer and the passivation layer are formed *in situ* by alternating layers of a first material and a second material, the composition of the absorption layer, the wider bandgap layer and the passivation layer being determined by the relative thicknesses of the layers of the first and second materials

and, after deposition of the layers of first and second materials, annealing the first and second materials to produce an alloy of the first and second materials;

patterning the doping layer;

driving dopant from the patterned doping layer into the wider bandgap layer and the radiation absorption layer to form a doped region;

patterning the passivation layer to expose the doped region; and

forming an electrical contact to the doped region.

7. A method as in Claim 6 wherein the first material is HgTe and the second material is CdTe.

8. A method as in Claim 6 wherein the first material is HgTe and the second material is $Cd_{1-y}Zn_yTe$, where y is selected to provide a target lattice constant.

9. A method as in Claim 8 wherein y = 0.056.

10. A method as in Claim 6 wherein the absorption layer includes HgCdTe.

11. A method as in Claim 6 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x Te$.

12. A method as in Claim 6 wherein the dopant is p-type.

13. A method as in Claim 6 wherein the dopant is Arsenic.

14. A radiation detector, comprising:

a substrate;

a radiation absorption layer above the substrate;

a wider bandgap layer above the radiation absorption layer;

a passivation layer above the wider bandgap layer;

a doped region extending through the passivation layer into the wider bandgap

layer and the radiation absorption layer; and

an electrical contact to provide electrical contact to the doped region.

15. A radiation detector as in Claim 14 wherein the absorption layer includes HgCdTe.

16. A radiation detector as in Claim 14 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x$ Te.

17. A radiation detector as in Claim 14 wherein a dopant of the doped region is p-type.

18. A radiation detector as in Claim 14 wherein a dopant of the doped region is arsenic.

19. A radiation detector as in Claim 14 wherein the radiation absorption layer is adapted to detect infrared radiation.

20. A radiation detector formed by a method comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a wider bandgap layer above the radiation absorption layer;

forming a passivation layer above the wider bandgap layer;

forming a doping layer above the passivation layer;

wherein the absorption layer, the wider bandgap layer and the passivation layer are formed *in situ* by alternating layers of a first material and a second material, the composition of the absorption layer, the wider bandgap layer and the passivation layer being determined by the relative thicknesses of the layers of the first and second material and, after deposition of layers of first and second material, annealing the first and second materials to produce an alloy of the first and second materials;

patterning the doping layer;

driving dopant from the patterned doping layer into the wider bandgap layer and

the radiation absorption layer to form a doped region;

patterning the passivation layer to expose the doped region; and

forming an electrical contact to the doped region.

21. A radiation detector as in Claim 20 wherein the first material is HgTe and the second material is CdTe.

22. A radiation detector as in Claim 20 wherein the first material is HgTe and the second material is $Cd_{1-y}Zn_yTe$, where y is selected to provide a target lattice constant.

23. A radiation detector as in Claim 22 wherein $y = 0.056$.

24. A radiation detector as in Claim 20 wherein the absorption layer includes HgCdTe.

25. A radiation detector as in Claim 20 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x Te$.

26. A radiation detector as in Claim 20 wherein the dopant is p-type.

27. A radiation detector as in Claim 20 wherein the dopant is Arsenic.

28. A method for forming a radiation detector, comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a passivation layer above the radiation absorption layer;

forming a patterned doping layer above the passivation layer;

driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region; and

forming an electrical contact to the doped region.

29. A method as in Claim 28 wherein the absorption layer includes HgCdTe.

30. A method as in Claim 28 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x$ Te.

31. A method as in Claim 28 wherein the dopant is p-type.

32. A method as in Claim 28 wherein the dopant is arsenic.

33. A method for forming a radiation detector, comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a passivation layer above the radiation absorption layer;

forming a doping layer above the passivation layer;

wherein the absorption layer and the passivation layer are formed *in situ* by alternating layers of a first material and a second material, the composition of the absorption layer and the passivation layer being determined by the relative thicknesses of the layers of the first and second materials and, after deposition of the layers of first and second materials, annealing the first and second materials to produce an alloy of the first and second materials;

patterning the doping layer;

driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region;

patterning the passivation layer to expose the doped region; and

forming an electrical contact to the doped region.

34. A method as in Claim 33 wherein the first material is HgTe and the second material is CdTe.

35. A method as in Claim 33 wherein the first material is HgTe and the second material is $Cd_{1-y}Zn_yTe$, where y is selected to provide a target lattice constant.

36. A method as in Claim 35 wherein $y = 0.056$.

37. A method as in Claim 33 wherein the absorption layer includes HgCdTe.

38. A method as in Claim 33 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x$ Te.

39. A method as in Claim 33 wherein the dopant is p-type.

40. A method as in Claim 33 wherein the dopant is Arsenic.

41. A radiation detector, comprising:

a substrate;

a radiation absorption layer above the substrate;

a passivation layer above the radiation absorption layer;

a doped region extending through the passivation layer into the radiation absorption layer; and

an electrical contact to provide electrical contact to the doped region.

42. A radiation detector as in Claim 41 wherein the absorption layer includes HgCdTe.

43. A radiation detector as in Claim 41 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x$ Te.

44. A radiation detector as in Claim 41 wherein a dopant of the doped region is p-type.

45. A radiation detector as in Claim 41 wherein a dopant of the doped region is arsenic.

46. A radiation detector as in Claim 41 wherein the radiation absorption layer is adapted to detect infrared radiation.

47. A radiation detector formed by a method comprising the steps of:

forming a radiation absorption layer above a substrate;

forming a passivation layer above the radiation absorption layer;

forming a doping layer above the passivation layer;

wherein the absorption layer and the passivation layer are formed *in situ* by alternating layers of a first material and a second material, the composition of the absorption layer and the passivation layer being determined by the relative thicknesses of the layers of the first and second material and, after deposition of layers of first and second material, annealing the first and second materials to produce an alloy of the first and second materials;

patterning the doping layer;

driving dopant from the patterned doping layer into the radiation absorption layer to form a doped region;

patterning the passivation layer to expose the doped region; and

forming an electrical contact to the doped region.

48. A radiation detector as in Claim 47 wherein the first material is HgTe and the second material is CdTe.

49. A radiation detector as in Claim 47 wherein the first material is HgTe and the second material is $Cd_{1-y}Zn_yTe$, where y is selected to provide a target lattice constant.

50. A radiation detector as in Claim 49 wherein $y = 0.056$.

51. A radiation detector as in Claim 47 wherein the absorption layer includes HgCdTe.

52. A radiation detector as in Claim 47 wherein the absorption layer includes $Hg_{1-x}(Cd_{0.944}Zn_{0.056})_x Te$.

53. A radiation detector as in Claim 47 wherein the dopant is p-type.

54. A radiation detector as in Claim 47 wherein the dopant is Arsenic.

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